Steunpunt beleidsrelevant onderzoek 3de generatie Studie- en Schoolloopbanen

EDUCATIONAL PATHWAYS OF STUDENTS WHO ENROLLED IN A SUBJECT-SPECIFIC TEACHER TRAINING IN FLANDERS

An Optimal Matching Approach

Steunpunt beleidsrelevant onderzoek 3de generatie
Studie- en Schoolloopbanen

EDUCATIONAL PATHWAYS OF STUDENTS WHO ENROLLED IN A SUBJECT-SPECIFIC TEACHER TRAINING IN FLANDERS

An Optimal Matching Approach

M. Smet & B. Janssens

Promotor: M. Smet

Research paper SSL/2014.01/3.1

Leuven, 16 mei 2014

Het Steunpunt Studie- en Schoolloopbanen is een samenwerkingsverband van KU Leuven, UGent, VUB, KU Leuven Campus Antwerpen en HUB.

Gelieve naar deze publicatie te verwijzen als volgt:
Smet, M. & Janssens, B. (2014). *Educational Pathways of students who enrolled in a subject-specific teacher training in Flanders: An Optimal Matching Approach*. Leuven: Steunpunt SSL, rapport nr. SSL/2014.01/3.1

Voor meer informatie over deze publicatie mike.smet@kuleuven.be

Deze publicatie kwam tot stand met de steun van de Vlaamse Gemeenschap, Programma Steunpunten voor Beleidsrelevant Onderzoek.

D/2014/4718/typ het depotnummer - ISBN typ het ISBN nummer

p.a. Secretariaat Steunpunt Studie- en Schoolloopbanen
HIVA - Onderzoeksinstituut voor Arbeid en Samenleving
Parkstraat 47 bus 5300, BE 3000 Leuven

Deze publicatie is ook beschikbaar via www.steunpuntSSL.be

Content

Figures

Tables

Beleidssamenvatting

In dit rapport worden de trajecten onderzocht van studenten die inschrijven in de specifieke lerarenopleiding (SLO) aan een hogeschool of universiteit. Meer specifiek wordt gekeken naar het traject dat deze studenten in het hoger onderwijs afgelegd hebben.

Teneinde deze analyses te kunnen uitvoeren werden verschillende administratieve data van een volledige cohorte studenten die afstudeerde in het secundair onderwijs in 2004-2005 gekoppeld. Hierdoor is het mogelijk om van individuele studenten hun traject in het hoger onderwijs, tot en met hun instroom in een SLO, te reconstrueren. Uit een eerste vergelijking van de instromers in een SLO met instromers in andere masters blijkt dat er een significant lagere instroom in de SLO is van mannelijke studenten en van studenten met niet-Belgische nationaliteit. Verder blijkt de studie-efficiëntie van SLO-studenten iets hoger dan die van andere master-studenten. SLO-studenten komen relatief meer uit een ASO- of KSO-richting en minder uit een TSO-richting dan studenten uit andere masteropleidingen.

Vervolgens werd Optimal Matching Analyses (Sequence Analysis) toegepast om de verschillende trajecten die studenten kunnen afleggen om tot een inschrijving in een SLO te komen te groeperen en te karakteriseren. De grootste groep (24.2%) volgt een traject van (voornaamste) inschrijving gedurende drie jaar in een academische bachelor, gevolgde door één jaar master en één jaar SLO. De tweede grootste groep stroomt via drie jaar academische bachelor en twee jaar master in een SLO in.

Op deze individuele trajecten werden clusteranalyses toegepast om een groepering van deze individuele trajecten mogelijk te maken. De clusters die het meest onderscheiden zijn van elkaar zijn studenten die een academische bachelor als vooropleiding hebben (n=1183) versus studenten met een professionele bachelor als vooropleiding (n=60). Wanneer opgesplitst wordt in een groter aantal clusters, is het de cluster met studenten met een academische bachelor die verder openbreekt in een aantal deelclusters.

Tenslotte werd door middel van (multinomiale) logistische regressies gepoogd om de toewijzing van studenten aan een bepaalde cluster te verklaren aan de hand van een aantal achtergrondkenmerken

van de studenten (onderwijsvorm in het secundair, nationaliteit, geslacht en schoolse vordering). In deze analyses konden nauwelijks significante determinanten geïdentificeerd worden. Dit is waarschijnlijk te verklaren door het feit dat de groep instromers in een SLO relatief homogeen is wat betreft achtergrondkenmerken (hoofdzakelijk vrouwelijk, met Belgische nationaliteit, weinig schoolse vertraging in het secundair en voornamelijk met een ASO vooropleiding).

Introduction

The landscape of teacher trainings in Flanders has considerably changed in the consequence of the Act on Teacher Training of 2006. Since September 2007, the multitude of teacher training programmes in Flanders was reduced to two types: the integrated and the subject-specific teacher training programmes. The integrated teacher training programmes last three years and lead to a degree that allows the graduates to teach in nursery, primary or lower secondary education, depending on the choice of field of study. The integrated teacher training programmes are called integrated because both subject-specific and didactic courses are included in the programme (Commissie Beleidsevaluatie Lerarenopleidingen 2013).

The subject-specific teacher training programmes are organized by university colleges, universities and centres for adult education and demand one year of full time education. In these programmes, the students are assumed to already master the subject-specific knowledge as a result of studies or professional experience and are focused on internships and didactic courses (Commissie Beleidsevaluatie Lerarenopleidingen 2013).

The focus in this report is on the profiles and educational pathways of students who enrolled in a subject-specific teacher training programme in university colleges and universities in Flanders. The aim of this report is thus twofold. First, we want to gain insight in the quality of the inflow in the subject-specific training programmes by comparing this inflow with the inflow in the master programmes in Flanders using descriptive statistics and univariate tests. Second, we want to gain insight in the entire educational pathways of the subject-specific teacher training programmes.

So far, the international literature on teacher training and careers has mainly focused on the occurrence of events in the (educational) careers of teachers. However, considering the definition of careers by Arthur & Rousseau (1996) as “sequences of work experiences over time”, we believe it to be interesting to address the educational pathways and careers of teachers from a more holistic point of view.

Optimal Matching Analysis Techniques allow us to gain a more holistic point of view on the educational pathways of students who enrolled in subject-specific teacher training programmes. This report will be the first exercise to gain insight in the educational pathways of Flemish students in higher education in general and more specific for Flemish subject-specific teacher training students.

For these analyses, data were provided by the Ministry of Education on the higher education pathways of an entire cohort of students who graduated in secondary education in the academic year 2004-2005.

The remainder of this report includes three chapters. The first chapter elaborates on the educational system and teacher training in Flanders. The second chapter describes the data and methodology that were used for the analyses, as well as some descriptive statistics. The third chapter reports on the results of the optimal matching analyses. The final chapter presents the implications for policy makers and indicates directions for further research.

Chapter 1 The education system and subject-specific teacher training in Flanders[1]

In this chapter, we shed some light on the education system of Flanders, which is schematically represented and simplified by Figure 1. We will only focus on the colleges and universities here, for reasons that will become clear later. It should however be kept in mind that there are many other possibilities in Flanders to continue education, such as formations in adult centres.

In Flanders, students have to hold a degree of secondary education before they are allowed to continue to higher education. Four different education forms can be distinguished when considering the third stage (i.e. the last two or three years) of Flemish mainstream secondary education[2]:

- General secondary education (ASO), which places an emphasis on broad general education. This form of education provides a firm foundation for passing on to tertiary education. This education form is used as reference category in the analyses.
- Technical secondary education (TSO), which places a special emphasis on general and technical/theoretical subjects. After this form of education, students can exercise a profession or pass on to tertiary education.
- Secondary arts education (KSO), which combines a broad general education with active arts practice. After this form of education, students can exercise a profession or go on to tertiary education.
- Vocational secondary education (BSO), which is a practice oriented type of education where students learn a specific occupation in addition to receiving general education.

  In Belgium, education is compulsory until the age of 18. However, from the age of 15 onwards, students following vocational secondary education can opt for part-time education.

The theoretical age to obtain a degree of secondary education is in general 18 when the student did not experience any school retardation. However, students in vocational secondary education need to

[1] This section is based on Department of Education and Training (2008). Education in Flanders. A broad view of the Flemish educational landscape. Brussels, Department of Education and Training: 68

[2] These definitions are taken from Department of Education and Training (2008). Education in Flanders. A broad view of the Flemish educational landscape. Brussels, Department of Education and Training: 68.

complete an additional year in secondary education in order to obtain their secondary degree which allows them to continue to higher education, leading to a theoretical age of 19 for these students when they graduate.

After secondary education, students can either opt for a professional or an academic bachelor programme if they continue to higher education. While Figure 1 may give us the impression that the educational pathways of students consist of chronological programmes, this is not true in Flanders anymore. The flexibilisation of higher education in 2005-2006 in Flanders does not longer demand that the students finish their bachelor's degree or another programme in which they are enrolled before enrolling in a subsequent programme. It is today perfectly possible for a student to enrol in several programmes simultaneously, as long as the conditions of entry are met. The pathways represented in Figure 1 and discussed below in this section should therefore not be understood as sequential.

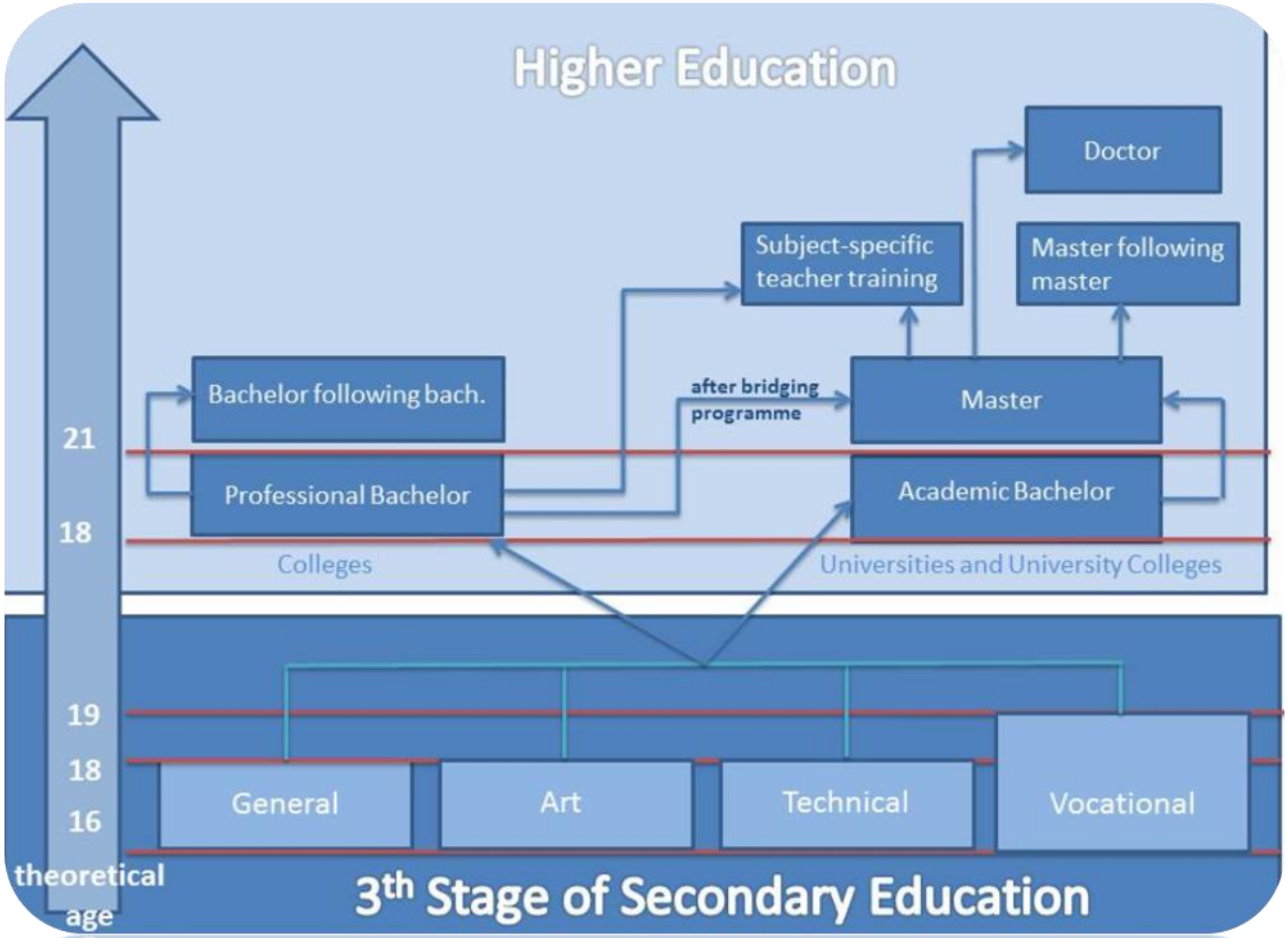
After a professional bachelor, a student can opt to enter a bachelor following bachelor programme, or, after the completion of a bridging programme, to enter a master programme. Students who have obtained sufficient credits in a professional bachelor can also opt to enrol in a subject-specific teacher training. After an academic bachelor, students generally enrol in a master's programme. Subsequently, they can opt for a master following master, a doctorate or a subject-specific teacher training. Finally, a multitude of postgraduate programmes, for which the conditions of entry vary, exist in Flanders.

The subject-specific teacher training in Flanders consists of 60 ECTS-credits, which can be understood as the equivalent of a full-time year of study. The conditions of admission that have to be satisfied to enter the teacher training programmes in these institutions as listed by the Act of 2006 vary depending on the educational trajectory of the student:

- In university colleges, students can enter a subject-specific teacher education programme after the completion of 120 credits in a professional bachelor programme. The degree of teacher will only be conferred after the student has completed the professional bachelor degree. (Vlaamse Overheid 2006).
- In both university colleges and universities, students who frequent or completed an academic bachelor programme are allowed to enrol in a subject-specific teacher training programme once they have enrolled in a master programme. However, the degree of teacher will only be conferred once the student has obtained his/her master degree (Vlaamse Overheid 2006).

As we already mentioned, the flexibilisation of higher education in Flanders made it possible for students to enrol in multiple programme simultaneously.

Figure 1: The education system and subject-specific teacher training in Flanders



Chapter 2 Methodology & Data

2.1 Optimal Matching Analysis: an Introduction

In this report, Optimal Matching Analysis (OMA) will be used to gain insight into the educational pathways of students who entered a subject-specific teacher training in a college or university in Flanders. OMA is a technique that only found its entrance relatively recently in the social sciences but has known an increasing number of applications in this domain (Kovalenko and Mortelmans 2011). This method makes it possible to consider trajectories from a more holistic point of view, rather than focusing on the occurrence of a single event.

OMA allows to consider state sequences, which can be defined as an ordered list of states on a time axis (Gabadinho, Ritschard et al. 2011). In order to conduct this type of analysis, one has to define a cost matrix that assigns costs to every possible substitutions, insertions and deletions required to transform one sequence into another. Next, various types of algorithms can be applied to minimize the cost paths or distances between the different sequences. Once this is done, classical tools such as cluster analysis can be applied in order to create a career taxonomy of these trajectories (Abbott and Forrest 1986; Gabadinho, Ritschard et al. 2011). This typology can then be related with covariates using traditional (multinomial) logistic regression techniques (Gabadinho, Ritschard et al. 2011).

While OMA is a very interesting technique to approach trajectories from a more holistic point of view, this method has frequently been criticized, mainly because of the concerns about the validity of the construction of the cost matrices. We will discuss this point of criticism later in more detail.

2.2 Data

The aim of this report is to consider the profiles and educational trajectories of students who enrol in a subject-specific teacher training. The data used in this report are subsets of newly linked administrative data provided by the Flemish Department of Education. We obtained data on the educational careers of an entire population cohort of 51.902 students who graduated from secondary education in the academic year 2004-2005 in Flanders. This dataset includes information on student characteristics (e.g. gender, nationality, year of birth, grade retention) and detailed

registration information of these students in the Flemish colleges and universities of the period 2005-2012. We also obtained information on the registrations in adult centres. However, the data from enrolment in adult centres was only available from the academic year 2007-2008, resulting in a gap of two years between the graduation cohort from secondary education (2004-2005) and first enrolment data in adult centres (2007-2008). We can therefore not reliably study the educational pathways of those students who enrolled in a subject-specific teacher training in adult centres.

2.3 Sample Characteristics & Comparison of SSTT students with Master Students

The data reveal that 1.243 unique students of our entire population cohort of 51.902 graduates from secondary education enrolled in a subject-specific teacher training programme between 2005 and 2012.

In Table 1, the evolution of the number of registrations in subject-specific teacher training (SSTT) programmes of this cohort of graduates can be seen. In the first three years of the considered time period, not a single student registered in a SSTT, which is as could be expected when the requirements to enrol in this type of programme are considered as was done in Chapter 1.

Table 1: Evolution of registrations in subject-specific teacher training programmes of a cohort of secondary education graduates in Flanders, 2005-2012

Academic year	Registrations	Deregistrations	Number of graduates
2005-2006	0	0	0
2006-2007	0	0	0
2007-2008	0	0	0
2008-2009	101	15	2
2009-2010	644	46	376
2010-2011	603	37	371
2011-2012	273	19	150

As from 2008 onwards, students start registering for an SSTT. In 2008, mainly students who finished a professional bachelor will enrol in an SSTT, since they can enrol immediately in this programme without needing a master's degree. The majority of registrations in SSTT occur in the academic years 2009 and 2010. This will probably mainly be students who finished an academic programme and finished or are enrolled in a master's programme.

Table 2 focusses on the gender of those registered in the SSTT programme. We can see that the ratio men/women is always about 3 to 7, with the exception of the last year considered, where

the ration men/women is closer to 4 to 6. The subject-specific teacher training programme is typically perceived as feminine.

Table 2: Gender of those who register in a SSTT of a cohort of secondary education graduates in Flanders, 2005-2012

Academic year	Number of men	Number of women	Percentage men	Percentage women
2008-2009	29	72	28.7%	71.3%
2009-2010	185	459	28.7%	71.3%
2010-2011	183	420	30.3%	69.7%
2011-2012	104	169	38.1%	61.9%

The feminine character of the SSTT becomes clear when the gender proportions of this programme are compared to those of the master's programme in general, where the men/women ratio more or less equalizes 5 to 5 as can be seen in table 3[3]. A chi-square confirms the gender proportions in SSTT and master's programmes are significantly different (value=143,132, df=1, p=0.000).

Table 3: Gender proportions of master versus SSTT considering all registrations over the period 2005-2012

	Master	SSTT
Men	47.9%	30.3%
Women	52.1%	69.7%

Table 4 reflects the number of non-Belgian students enrolled in the SSTT programme by academic year. We can see their numbers are negligible.

Table 4: Number and proportion of non-Belgian students who register in a SSTT of a cohort of secondary education graduates in Flanders, 2005-2012

Academic year	Number of students without Belgian nationality	% of students without Belgian nationality
2008-2009	0	0.00%
2009-2010	2	0.30%
2010-2011	4	0.70%
2011-2012	4	1.50%

In Table 5 the overall inflow of non-Belgian students in the SSTT programme is compared to the inflow of non-Belgian students in all the master programmes over the entire period 2005-2012.

[3] We compare the characteristics of those who enrolled in an SSTT with those who enrolled in a master's programme instead of comparing them to both the masters and professional bachelor programmes because only 5% of our sample of SSTT students were ever enrolled in a professional bachelor. This will become clear in the section on the results of the optimal matching analysis. In total, 13.482 students enrolled in master programmes are compared to the 1.243 students enrolled in SSTT programmes.

While the general international character of the master's programmes can be viewed as low with an inflow of non-Belgian students of 1.3%, a chi-square test indicates this is significantly higher than the inflow of non-Belgian students in the SSTT programme (value=4.891, df=1, p=0.028).

Table 5: Nationality proportions of master versus SSTT programme considering all registrations over the period 2005-2012

	Master	SSTT
Belgian nationality	98.70%	99.40%
Other	1.30%	0.60%

In Table 6 we can see the distribution of educational forms (secondary education) in the SSTT programme according to the years of registration. We can see that in the academic year 2008-2009 the level of students who frequented art in secondary education is higher than in the other years considered, while the level of students who were enrolled in general secondary education is lower than in the other academic years. This will probably have something to do with the fact that in the academic year 2008-2009, mainly students who come from a professional bachelor will enrol in a SSTT.

Table 6: Distribution of educational forms of students who register in a SSTT of a cohort of secondary education graduates in Flanders, 2005-2012

Academic year	% general	% vocational	% art	% technical
2008-2009	78.2%	0.0%	18.8%	3.0%
2009-2010	92.1%	0.2%	5.6%	2.2%
2010-2011	88.6%	0.2%	6.5%	4.8%
2011-2012	88.3%	0.0%	5.5%	6.2%

In Table 7 we compared the overall inflow of the different educational forms over the considered time period between the master programmes and the SSTT programmes. A chi square test indicated that there are significant differences between the proportion of educational forms between both type of programmes (value=125.911, df=3, p= 0,000). When comparing the SSTT to the master programmes mainly the higher levels of students who were enrolled in an art-oriented programme in secondary education and lower levels of students who were enrolled in technical secondary education in the SSTT programmes become apparent.

Table 7: Educational form proportions of master versus SSTT programme considering all registrations over the period 2005-2012

	Master	SSTT
% general	87.2%	90.2%
% vocational	0.2%	0.1%
% art	1.9%	5.8%
% technical	10.6%	4.0%

Table 8 reflects the average study efficiency of students enrolled in a SSTT programme by academic year. Study efficiency is calculated as the percentage of credits the student obtained compared to the number of credits registered during his entire educational career in higher education. We can see that the study efficiency in 2008-2009 is lower than in the other academic years, which could be due to the fact that these students mainly come from professional bachelor programmes.

Table 8: Study efficiency of students who register in a SSTT of a cohort of secondary education graduates in Flanders, 2005-2012

Academic Year	Average study efficiency
2008-2009	62.86%
2009-2010	83.65%
2010-2011	81.24%
2011-2012	72.40%

In Table 9, the overall study efficiency of students enrolled in master versus SSTT programmes are compared. While the difference in study efficiency between both groups is little more than 1 percent, an independent T-test where unequal variances where assumed indicated this difference to be significant (t=-3,868, df=1582, p=0.000).

Table 9: Comparison study efficiency of master versus SSTT programmes, 2005-2012

	Master	SSTT
Average study efficiency	87.43%	88.67%
SD study efficiency	12.39	10.64

In this section, we learnt significant differences in characteristics exist when master students are compared to students who enrolled in a subject-specific teacher training in Flanders. Students who enrolled in a subject-specific teacher training programme are more likely to be female, Belgian and to have a degree in general secondary education than master's students.

Chapter 3 Optimal Matching Analysis

3.1 Operationalization

To facilitate an Optimal Matching Analysis, a simplification of the dataset was necessary since many students are enrolled in multiple programmes simultaneously. Therefore, for every academic year, we filtered out the most important registration, by which we mean the registration with the most credits, of a given student. This way, we have only one observation per student per time period, namely his/her major registration in higher education in that specific academic year.

The fact we only consider the most important registration per period has as a major disadvantage that we simplify the reality of the flexibilisation of higher education and that nowadays in Flanders more and more students are enrolled in a multitude of programmes simultaneously. However, this simplification was necessary to make the analyses feasible.

Considering the students who are enrolled in a subject-specific teacher training, however, we coded a different type of state when a student was enrolled in both a subject-specific teacher training programme and another programme, while the latter is the most important registration. We noted while constructing our dataset that too many students enrolled in an SSTT would not be taken into account in our analysis if we would not have created a different state for this type of situation. This way, we could create an alphabet of nine different possible states for the Optimal Matching Analysis. The coding and labels of these states can be found in Table 10.

Table 10: Alphabet of the Optimal Matching Analysis

SLO	Most important or only registration is for a **Subject-Specific Teacher Training programme**
PBA	Most important or only registration is for a **Professional Bachelor Programme**
ABA	Most important or only registration is for an A**cademic Bachelor Programme**
MA	Most important or only registration is for a **Master programme**
BRIDGE	Most important or only registration is for a **Bridging Programme**
AFTERMA	Most important or only registration is for a **Master-after-Ma or Doctor programme**
POSTGRAD	Most important or only registration is for a **Postgraduate programme or a Bachelor-after-Bachelor programme**
OTHER	This state can indicate a student is not registered in higher education anymore or is enrolled in a credit or exam contract in higher education. In most cases, however, this state will indicate a person has entered the labour market
MULTISLO	Student is enrolled in both a Subject-Specific Teacher Training Programme and one or multiple other programmes

With regard to the cost or distance matrix that has to be defined for the Optimal Matching Analysis, we opted for the traditional insertion/deletion cost of 1, which is the default in the TraMineR package in R used to conduct the analyses. We specified the substitution costs based on the transition rates between the different states. Since the cost matrix is a major point of criticism towards OMA, we alternatively conducted our analyses using constant substitution costs. Since the results were very similar and thus robust, we will only report the results of the analyses wherein substitution costs depend on transition rates.

3.2 Results

1. The most representative pathway of a subject-specific teacher training student

To start our analyses of the educational career trajectories of those students of our cohort who enrolled in a subject-specific teacher training between 2005 and 2012 in Flanders, we generated the medoid of all trajectories. The medoid is that trajectory that is the most representative for all the other trajectories in our dataset, that has a minimal distance to all other trajectories in the sample (Gabadinho, Ritschard et al. 2011).

Figure 2: Medoid of trajectories

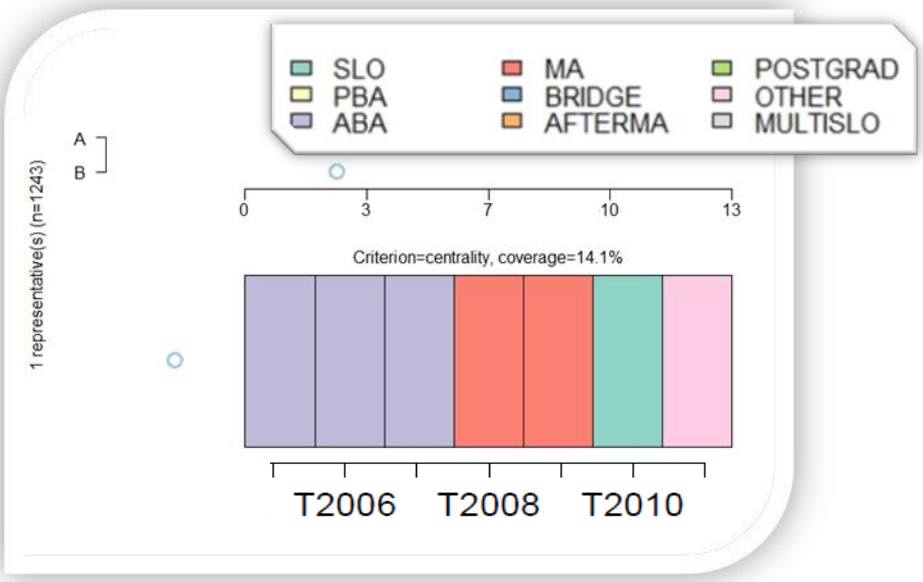
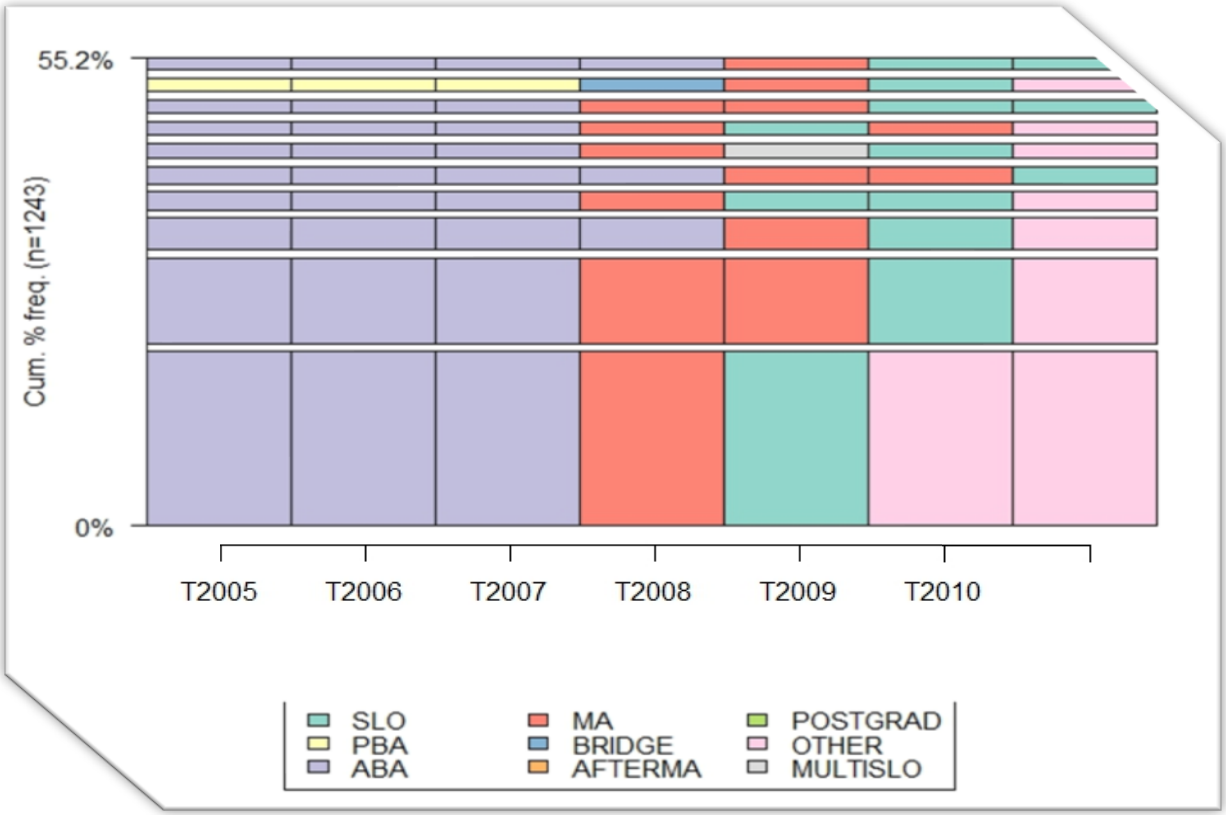


Figure 2 represents the medoid of all the trajectories of SSTT students. The most representative trajectory for our entire sample consists of three years in an academic bachelor programme, two years in a master's programme, followed by one year in a subject-specific teacher training programme, and finally the other-state, which probably indicates the entrance of these students in the labour market.

2. The 10 most frequent trajectories

In Figure 3 we see a representation of the ten most frequent trajectories. The trajectories of 55.2 percent of all students are covered by these 10 types of trajectories. These trajectories are also represented by Table 11, in which the exact coverage per trajectory can be found. The by far most frequent trajectory is the trajectory "ABA/3-MA/1-SLO/1-OTHER/2", which has coverage of 22.4 percent of all students. This trajectory can be read as a student that enrolled in a 3-year bachelor programme (ABA/3), followed by a 1-year master (MA/1) and consequently the subject-specific teacher training programme (SLO/1) during one academic year. After this five year period this student cannot be traced anymore during the remaining two years in the higher education databases of the Ministry of Education (OTHER/2).

Figure 3: The 10 most frequent trajectories of subject-specific teacher training students



The second most frequent trajectory is "ABA/3-MA/2-SLO/1-OTHER/1" with coverage of 12 percent. In this trajectory, students are enrolled for a period of two years in a master's programme. This can both be students who are enrolled in a master's programme of two years, as well as students who are enrolled in a master's programme of one year but take two years to complete. It is clear from

this table that the number students originating from a professional bachelor who en enrol in an SSTT (after completing a bridging programme and a master) is relatively small.

Table 11: the 10 most frequent trajectories

Type of trajectory	number of students	coverage (%)
ABA/3-MA/1-SLO/1-OTHER/2	301	24.2
ABA/3-MA/2-SLO/1-OTHER/1	149	12.0
ABA/4-MA/1-SLO/1-OTHER/1	55	4.4
ABA/3-MA/1-SLO/2-OTHER/1	32	2.6
ABA/4-MA/2-SLO/1	30	2.4
ABA/3-MA/1-MULTISLO/1-SLO/1-OTHER/1	26	2.1
ABA/3-MA/1-SLO/1-MA/1-OTHER/1	25	2.0
ABA/3-MA/2-SLO/2	24	1.9
PBA/3-BRIDGE/1-MA/1-SLO/1-OTHER/1	24	1.9
ABA/4-MA/1-SLO/2	20	1.6

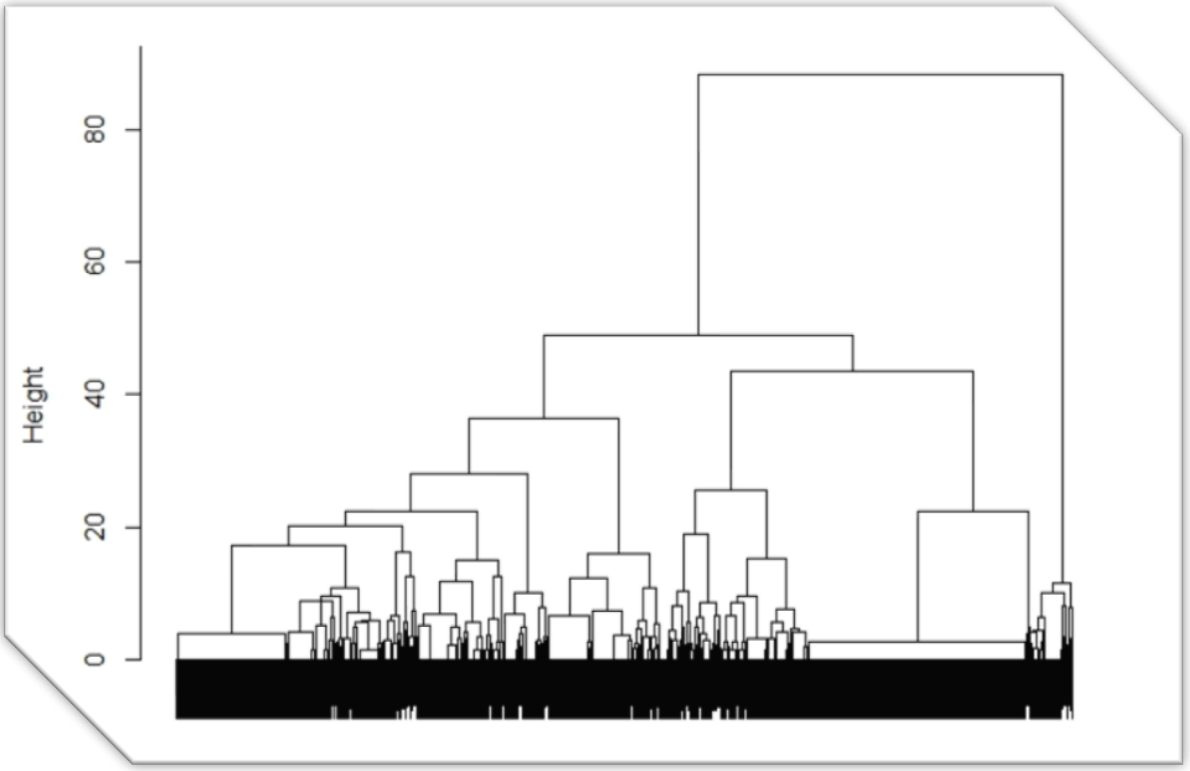
Since 55.2 percent of the students are covered by the largest 10 trajectories, 48.2 percent of the students have a trajectory that is shared with less than 20 other students.

3. Bringing student's profiles together: Dendrogram of Ward's cluster analysis

Now we have gained some insight in the most frequent and typical trajectories of the students who enrolled in an SSTT, we will in a next step perform a cluster analysis to see whether we can create career taxonomy of the educational pathways of these students. We created a dendrogram of a Ward's cluster analysis, as can be seen in Figure 4.

The dendrogram does not show any evident number of clusters that should be considered in a cluster analysis. It is however obvious that the student pathways are in a first step clearly divided into two groups and that one of these two groups is very small compared to the other. Closer inspection of the dendrogram does not lead to a clear conclusion on how many clusters should be retained in further analyses. We will therefore perform ward's cluster analyses where 2 up to 5 clusters are included.

Figure 4: Dendrogram of Ward's cluster analysis



4. Academic versus Professional: Ward's cluster analysis with two clusters

Figure 5 and 6 reflect the results of a cluster analysis in which two clusters are included. They allow us to gain insight in the clear division in two groups we saw in the dendrogram in the previous section. We can see that the first cluster consists of those students who were enrolled in an academic bachelor programme, while the second cluster consists of students who were enrolled in a professional bachelor programme at the beginning of their educational career. The latter group does only include 60 students, while 1183 students populate Cluster 1. The result of this cluster analysis is as expected since substitution costs are based on transition rates.

Figure 5: Plots of representative sequences by cluster

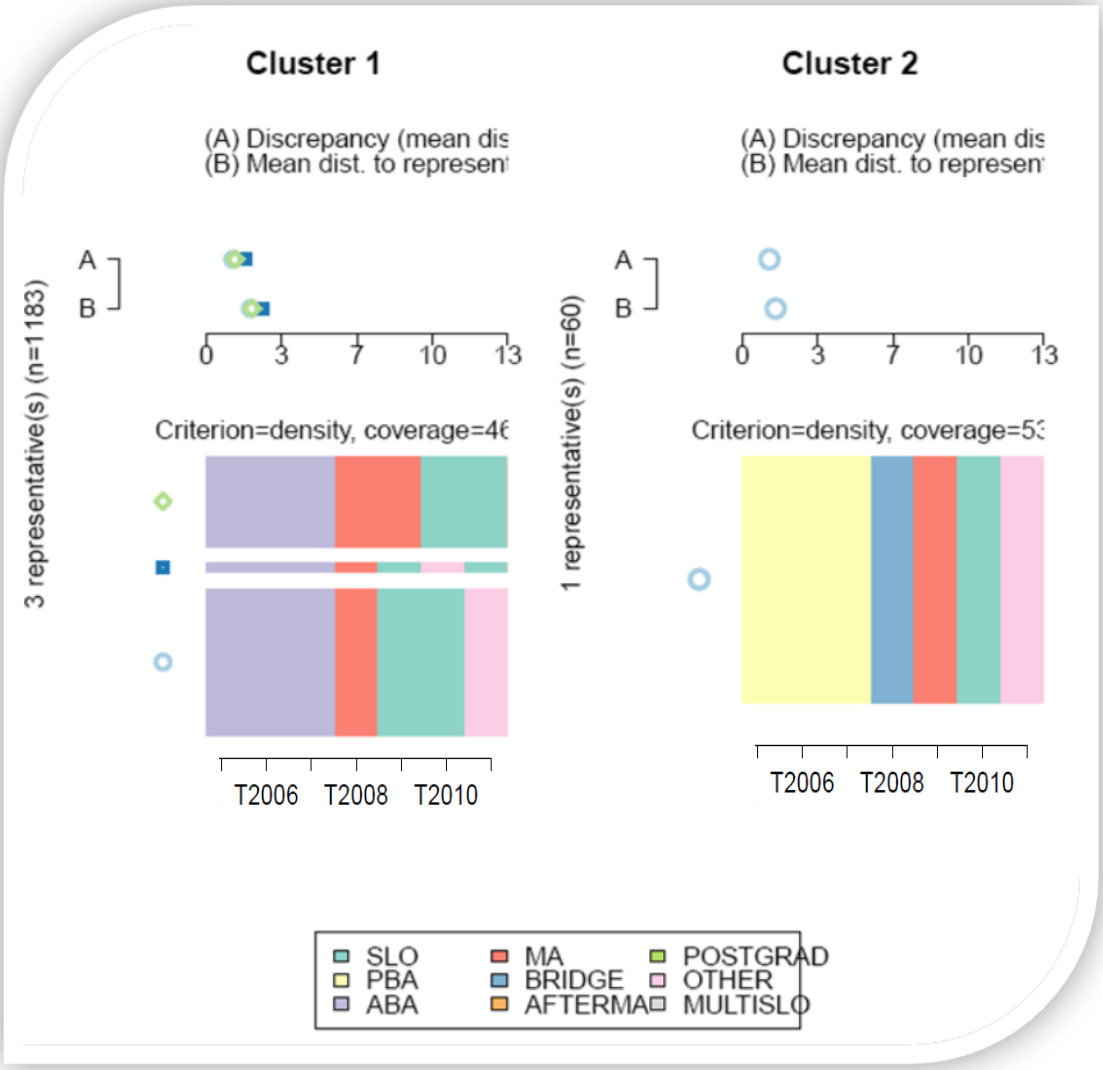
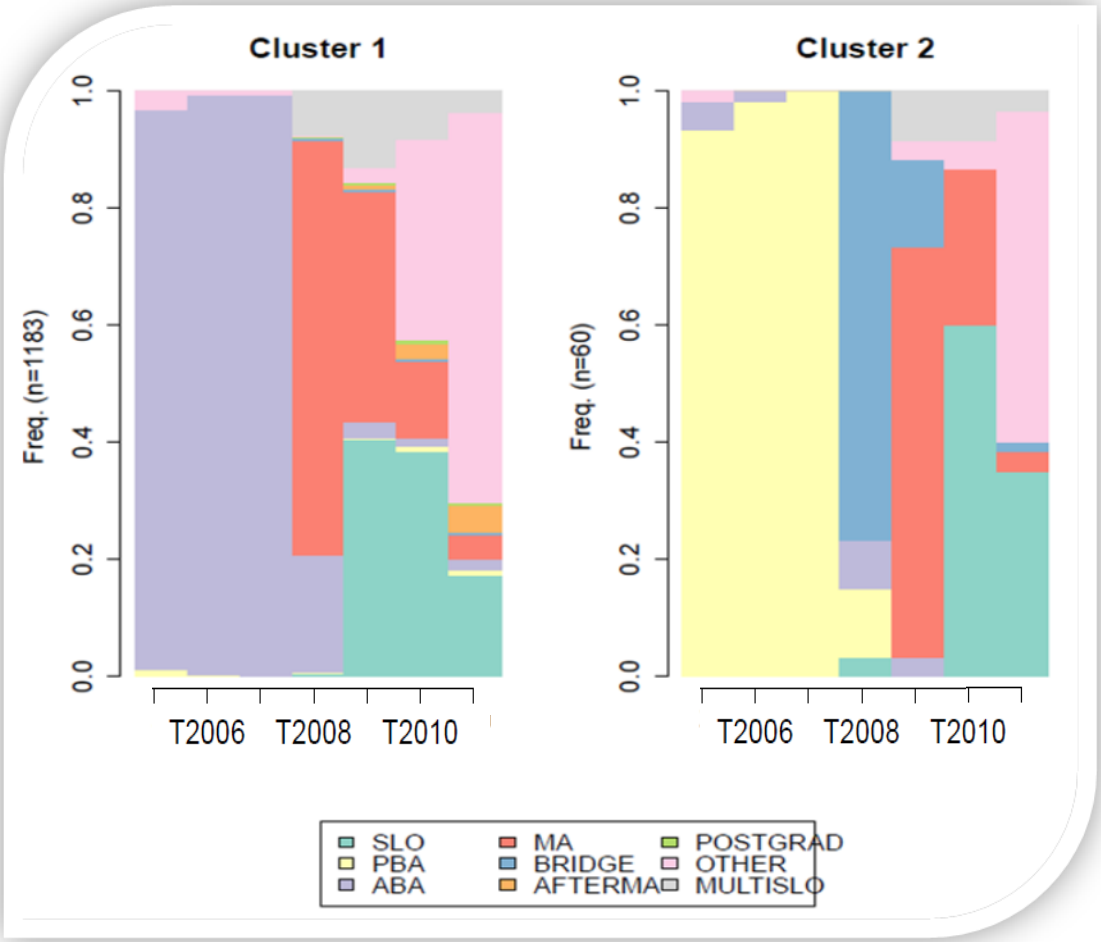


Figure 6 reflects for every period the proportion of students in the different states in the separate clusters. We can see that the students in the second cluster typically enter a bridging programme after their professional bachelor, after which they enrol in a master's programme before enrolling in a subject-specific teacher training. Clearly, the possibility to enrol in a subject-specific teacher training after the completion of a professional bachelor programme is not a trajectory a lot of students opt for.

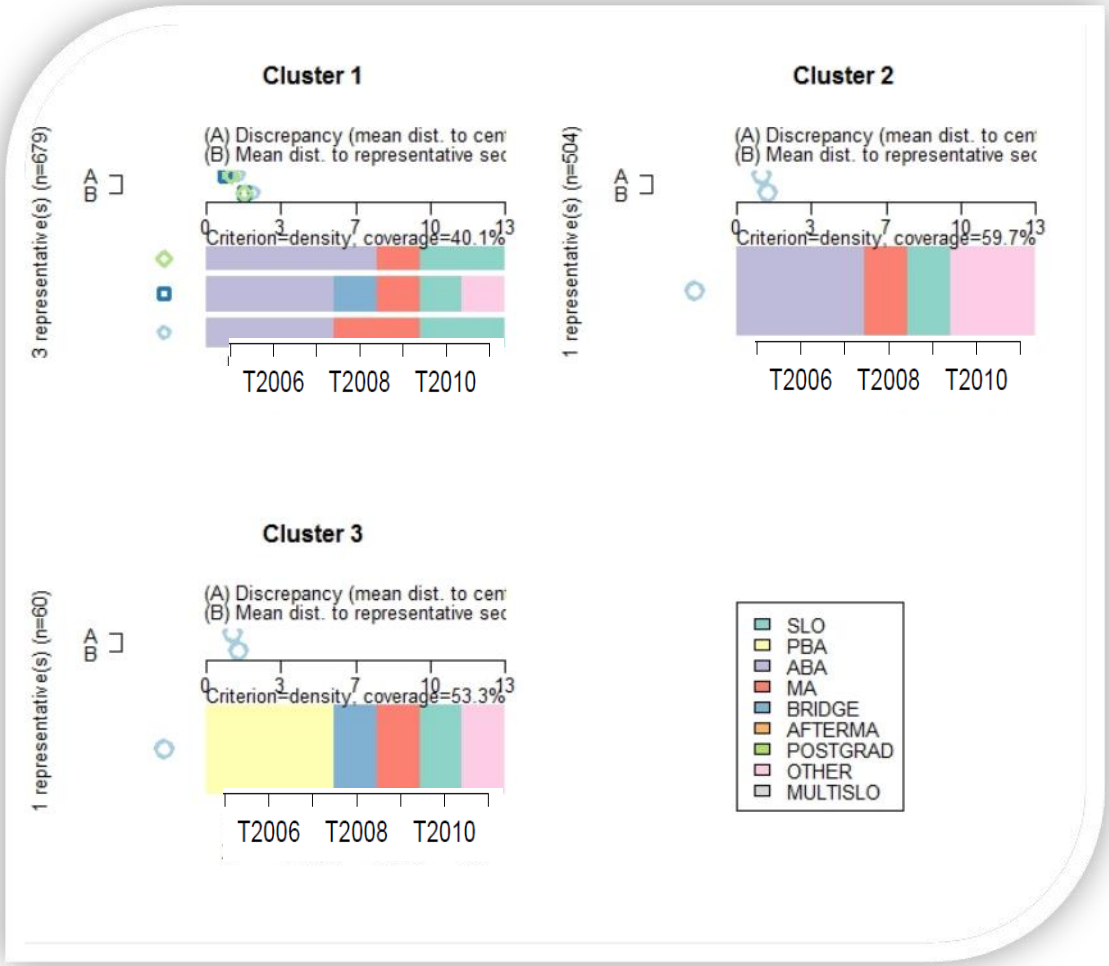
Figure 6: Transversal state distributions by cluster



5. Ward's cluster analysis with three clusters

When conducting the cluster analysis while opting for three clusters, Cluster 1 of the two cluster-analysis is split into two smaller groups. Cluster 1 in Figure 7 represents a group of students who were initially enrolled in an academic programme, after which they continued their educational pathways in different ways. This is indicated by the fact not one peculiar medoid exists for this cluster. The three most representative trajectories are given in Figure 7.

Figure 7: Plots of representative sequences by cluster

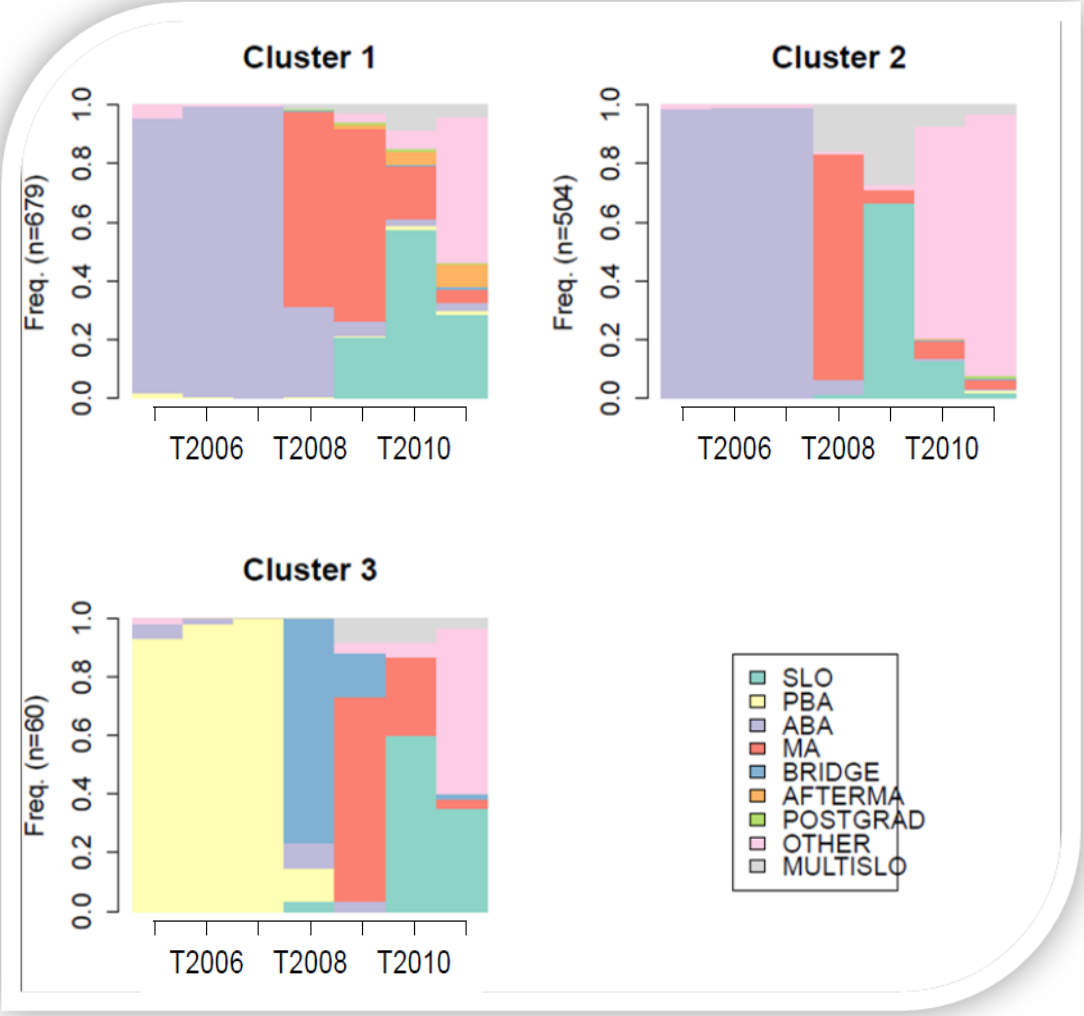


The medoid of the second cluster of this cluster analysis equalizes the most frequent trajectory of our entire dataset: “ABA/3-MA/1-SLO/1-OTHER/2”. The third cluster is the professional bachelor cluster. Figure 8 represents the transversal state distributions of the different clusters. We can see that in Cluster 2 a considerable amount of students enrol in a subject-specific teacher training programme while simultaneously enrolled in another programme (MULTISLO).

When we allow for more clusters in the Ward’s cluster analysis, Cluster 1 and 2 of the previously described analysis are split up in more subdivisions of the academic trajectories. More specifically, Cluster 2 will be split up in two clusters with as representative trajectories “ABA/3-MA/2-SLO/1-OTHER/1” for the first one and for the second one “ABA/3-MULTISLO/1-SLO/1-OTHER/2” and “ABA/3-MA/1-MULTISLO/1-OTHER/1”. Cluster 1 will in a 5 cluster solution be subdivided in clusters

with as representative trajectories “ABA/3-MA/2-SLO/2” and “ABA/4-MA/1-SLO/2”. The figures of these analyses can be found in Appendix A.

Figure 8: Transversal state distributions by cluster



6. Multinomial Models

In a next step, we use the group membership of students in the different clusters as dependent variables in (multinomial) logistic regressions to investigate whether the different clusters are characterized by students with different backgrounds. These analyses, however, led to very few significant results.

In Table 12, the results of a logistic regression where the academic and professional trajectory clusters are compared to each other can be found. The only significant difference regarding education form, nationality, grade retention and gender to be found was a significant higher likelihood of having frequented technical secondary education compared to general secondary education when a student was positioned in the academic trajectory cluster.

The other multinomial regression models where more clusters where compared, did not lead to significant conclusions regarding differences in characteristics of their student profiles.

Table 12: Logistic regression comparing characteristics of the two clusters, reference category = clusters of students who enrolled in an academic bachelor programme

Reference category = professional	Estimate	Std. Error	z-value	p-value
intercept	-17.12	3956.18	-0.004	0.997
education form (ref. = general)				
vocational	-14.93	3956.18	-0.004	0.997
art	-0.03	0.62	-0.041	0.968
technical	2.27	0.37	6.090	0.000***
nationality_not_belgian	-1.03	4693.05	0.000	1.000
grade retention (ref. = one year of retardation)				
one year of school advancement	-14.85	789.51	-0.019	0.985
two years of retardation	0.07	1.26	0.058	0.954
normally advanced	-0.45	0.44	-1.017	0.309
Female	0.53	0.32	1.643	0.100*

*: p<0.10; **:p<0.05; ***:p<0.001

Chapter 4 Discussion & Conclusion

In this report, the educational profiles and pathways of students who enrolled in a subject-specific teacher training programme in a university or university college in Flanders were considered. Data on the characteristics of an entire cohort of students who graduated from secondary education in 2004-2005 were provided by the Department of Education. These data were linked to all registrations in higher education between 2005 and 2012 of these students, after which all students who enrolled in a subject-specific teacher training were selected for analysis, resulting in a dataset reflecting the education trajectories of 1.243 students.

Descriptive statistics indicated a very high proportion of these students are female and obtained a degree of general secondary education. Very few students (< 1 percent) have a non-Belgian nationality.

Little to nothing was known about the education trajectories these students completed before enrolling in a subject-specific teacher training programme. In this report, we attempted to fill part of this gap by applying sequence analysis to visualize the trajectories of students who enrolled in a subject-specific teacher training programme at a certain point in their educational career.

In order to perform a sequence analysis, it is necessary to define transition and substitution costs to calculate distances that reflect the similarity or dissimilarity of different trajectories. In this case, we defined the cost matrix by linking costs to transition rates. This way, we found the medoid, the trajectory with a minimal distance to all other trajectories and thus the most representative trajectory for all subject-specific teacher training students, to be given by “ABA/3-MA/2-SLO/1-OTHER/1” which can be read as a trajectory of three years of enrolment in an academic bachelor, two years in a master’s programme, one year in the subject-specific teacher training programme, after which the student enters the labour market.

This trajectory, “ABA/3-MA/2-SLO/1-OTHER/1”, is the exact trajectory of 12 percent of the subject-specific teacher training students. The most frequent trajectory, with coverage of 24.2 percent of all students, is “ABA/3-MA/1-SLO/1-OTHER/2”.

The application of a cluster analysis led to a clear distinction of the students in two groups, more specifically a group of students who completed a professional bachelor and a group who completed an academic bachelor before enrolling in the subject-specific teacher training programme. Cluster analyses wherein more than two clusters were allowed led to different subdivision of the academic group. While the visualization of these trajectories is interesting, the applicability of sequence analysis was in this case rather limited, since the results are inherent to the education system of Flanders. The subdivision of the academic and professional cluster did not come as a surprise, since the cost matrix is based on transition rates.

So far, sequence analysis has to our knowledge only been applied to situations where all states were possible at all times. In our case, however, it was for example not possible to be enrolled in a teacher training before having completed a bachelor or master's programme. The applicability of sequence analyses in the case where enrolment in any state is not possible is probably more expanded than those considered in this report, and further exploration should be done in the future.

Another disadvantage of this study is the simplification of the educational system and the variety of programmes, which was necessary to define the nine different states that were considered. Typically, only seven to eight different states are defined as the 'alphabet' for a sequence analysis. It would for example be possible to focus in further research on a different type of subject-specific teacher training and as such define a more specific alphabet to investigate the educational trajectories of these students. The simplification of the reality in our case also neglects the flexibilisation of higher education and does not allow us to consider multiple simultaneous registrations, as we only selected the major registration at each time period of every student.

The multinomial regression analyses made clear that different cluster membership cannot be explained by differences in characteristics such as gender, grade retention, nationality and education form in secondary education. It is however likely that students with different education pathways differ in interests, motivation and backgrounds. Further research is necessary to define the reasons certain students opt for other educational pathways than others.

While many drawbacks of sequence analysis can be stated, such as the necessary simplification of reality and the definition of a cost matrix, the visualization of these trajectories can be interesting to gain more insight in the pathways there students went through before entering the labour market. We can for example state that there is very little evidence of students who enrolled in the labour

market and returned to higher education to enrol in a teacher training, at least not in the considered time span of our analyses.

Bibliography

Abbott, A. and J. Forrest (1986). "Optimal matching methods for historical sequences." Journal of Interdisciplinary History: 471-494.

Arthur, M. B. and D. M. Rousseau (1996). The boundaryless career: A new employment principle for a new organizational era, Oxford University Press.

Commissie Beleidsevaluatie Lerarenopleidingen (2013). Beleidsevaluatie lerarenopleidingen: Rapport van de Commissie Beleidsevaluatie Lerarenopleidingen. Brussels.

Department of Education and Training (2008). Education in Flanders. A broad view of the Flemish educational landscape. Brussels, Department of Education and Training**:** 68.

Gabadinho, A., G. Ritschard, et al. (2011). "Analyzing and visualizing state sequences in R with TraMineR." Journal of Statistical Software **40**(4): 1-37.

Kovalenko, M. and D. Mortelmans (2011). Career patterns in the XX century. An interplay of gender, family and career success. Brussels, Steunpunt Werk en Sociale Economie**:** 57.

Vlaamse Overheid (2006). Decreet betreffende de lerarenopleidingen in Vlaanderen. Brussels**:** 10.

Background information sequence analysis

Abbott, A. (1995). "Sequence analysis: new methods for old ideas." Annual review of sociology **21**(1): 93-113.

Abbott, A. and A. Tsay (2000). "Sequence analysis and optimal matching methods in sociology review and prospect." Sociological methods & research **29**(1): 3-33.

Brzinsky-Fay, C. (2007). "Lost in transition? Labour market entry sequences of school leavers in Europe." European Sociological Review **23**(4): 409-422.

Gabadinho, A., G. Ritschard, et al. (2009). "Mining sequence data in R with the TraMineR package: A users guide for version 1.2." Geneva: University of Geneva.

Ritschard, G. (2012). Exploring sequential data. Discovery Science, Springer.

McVicar, D. and M. Anyadike-Danes (2002). "Predicting successful and unsuccessful transitions from school to work by using sequence methods." Journal of the Royal Statistical Society: Series A (Statistics in Society) **165**(2): 317-334.

Ritschard, G., A. Gabadinho, et al. (2008). "Mining event histories: a social science perspective." International Journal of Data Mining, Modelling and Management **1**(1): 68-90.

APPENDICES

Appendix A Solutions of the Ward's cluster analyses with 4 and 5 clusters

Figure 9: Plots of representative sequences by cluster, 4 cluster solution

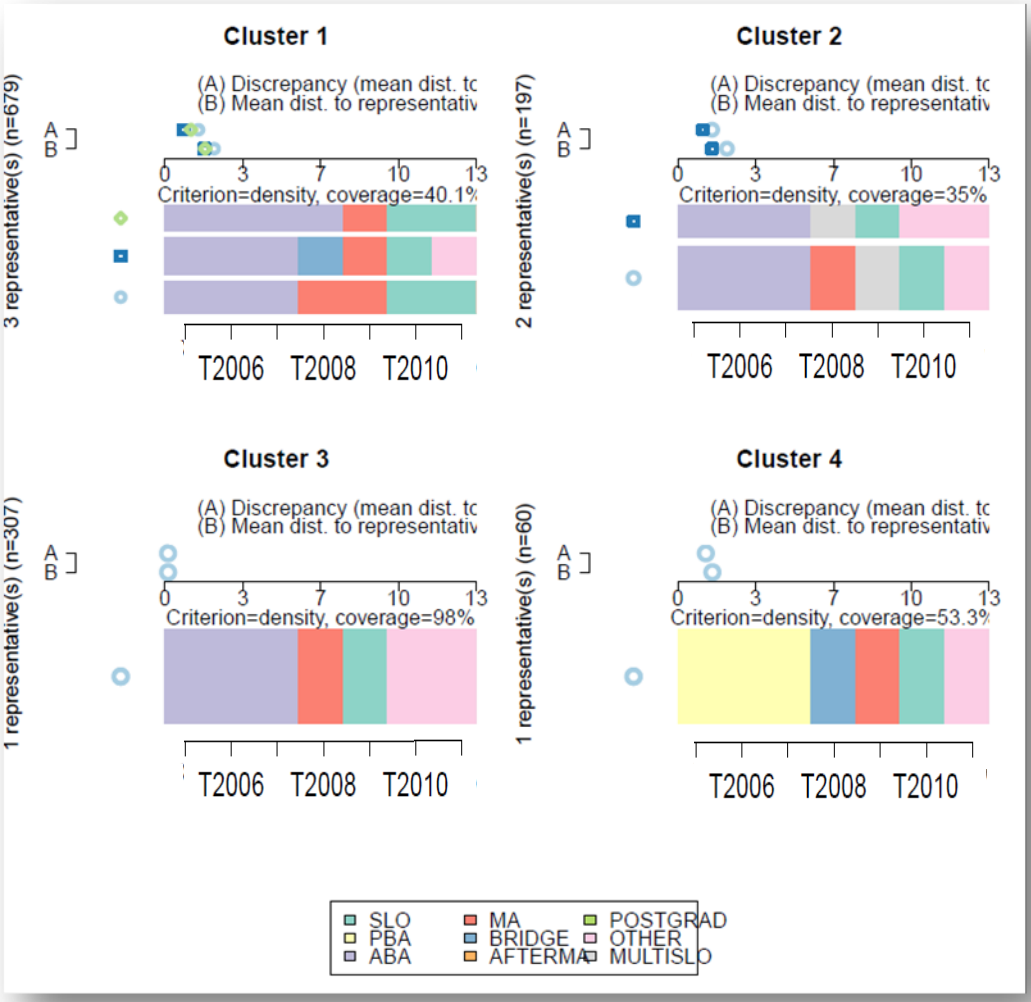


Figure 10: Plots of representative sequences by cluster, 5 cluster solution